

What is Claimed:

- 1 1. A method of packaging a semiconductor device including a
2 plurality of elements, the method comprising the steps of:

3 applying an insulative material to at least a portion of the
4 semiconductor device, the insulative material including insulative particles
5 having a diameter smaller than a gap between adjacent conductors providing
6 interconnection between the elements; and

7 curing the insulative material.
- 1 2. The method of claim 1 wherein said applying step includes
2 applying the insulative material including silica particles and a polymer resin.
- 1 3. The method of claim 1 wherein said curing step includes
2 exposing the insulative material to at least one of ultraviolet, visible, and
3 infrared radiation.
- 1 4. The method of claim 1 wherein said curing step includes
2 heating the insulative material and exposing the insulative material to at least
3 one of ultraviolet, visible, and infrared radiation.
- 1 5. The method of claim 1 wherein the curing step includes
2 applying a thermal process to the insulative material including a ramp up in
3 temperature, a soak in temperature, and a ramp down in temperature.
- 1 6. The method of claim 1 wherein the applying step includes
2 applying the insulative material to the device wherein the insulative particles
3 occupy between 50 and 85 percent of the volume of the insulative material.
- 1 7. The method of claim 1 wherein said applying step includes
2 applying the insulative material to the device wherein the insulative particles
3 have a maximum diameter of 20 microns.

1 8. The method of claim 1 wherein said applying step includes
2 applying the insulative material to the device wherein the insulative particles
3 have a median diameter of approximately 4.5 microns.

1 9. The method of claim 1 wherein said applying step includes
2 applying the insulative material to the device wherein the insulative particles
3 have a mean diameter of approximately 4.1 microns.

1 10. The method of claim 1 wherein through said applying step
2 the insulative particles disperse between adjacent ones of the conductors,
3 thereby providing insulated separation between the ones of the conductors.

1 11. The method of claim 1 further comprising the step of:

2 heating the semiconductor device to a temperature of between

3 50 and 125°C before the applying step.

1 12. The method of claim 1 further comprising the step of:

2 heating the semiconductor device to a temperature of between

3 80 and 100°C before the applying step.

1 13. The method of claim 1 further comprising the step of:

2 heating the insulative material to a temperature between 35 and

3 85 °C before the applying step.

1 14. The method of claim 1 further comprising the step of:

2 heating the insulative material to a temperature between 50 and

3 70 °C before the applying step.

1 15. The method of claim 1 further comprising the step of:
2 encapsulating the semiconductor device.

1 16. The method of claim 15 wherein said encapsulating step
2 includes encapsulating the semiconductor device with an overmold
3 encapsulant.

1 17. The method of claim 15 wherein said encapsulating step
2 includes encapsulating the semiconductor device with a globtop encapsulant.

1 18. The method of claim 1 wherein said applying step includes
2 applying the insulative material to a semiconductor element positioned at a
3 substantially central portion of the semiconductor device, such that the
4 insulative material disperses from the semiconductor element onto the
5 plurality of conductors.

1 19. The method of claim 1 further comprising the step of:

2 drawing at least one of the insulative particles between adjacent
3 ones of the conductors, thereby separating the adjacent ones of the
4 conductors, the adjacent ones of the conductors previously being in contact
5 with one another before said step of drawing.

1 20. The method of claim 1 further comprising the step of:

2 providing a period of time between 2 and 50 seconds for the
3 insulative material to flow prior to said curing step, the period of time being
4 selected based on at least one of a size of the semiconductor device, a
5 temperature of the semiconductor device, a temperature of the insulative
6 material during said step of applying, and a density of the conductors
7 providing interconnection between the elements.

1 21. The method of claim 1 further comprising the step of:

2 providing a period of time between 7 and 25 seconds for the
3 insulative material to flow prior to said curing step, the period of time being
4 selected based on at least one of a size of the semiconductor device, a
5 temperature of the semiconductor device, a temperature of the insulative

6 material during said step of applying, and a density of the conductors
7 providing interconnection between the elements.

1 22. A semiconductor device comprising:

2 a plurality of semiconductor elements;

3 a plurality of conductors providing interconnection between said
4 plurality of semiconductor elements; and

5 an insulative material including insulative particles having a
6 diameter smaller than a gap between adjacent ones of said plurality of
7 conductors, said insulative material covering at least a portion of said plurality
8 of conductors.

1 23. The semiconductor device of claim 22 wherein said
2 insulative material includes a polymer resin, and said insulative particles are
3 silica particles.

1 24. The semiconductor device of claim 22 wherein said
2 insulative material is at least partially cured by at least one of ultraviolet,
3 visible, and infrared radiation.

1 25. The semiconductor device of claim 22 wherein said
2 insulative particles occupy between 50 and 85 percent of the volume of said
3 insulative material.

1 26. The semiconductor device of claim 22 wherein said
2 insulative particles have a maximum diameter of 20 microns.

1 27. The semiconductor device of claim 22 wherein said
2 insulative particles have a median diameter of approximately 4.5 microns.

1 28. The semiconductor device of claim 22 wherein said
2 insulative particles have a mean diameter of approximately 4.1 microns.

1 29. The semiconductor device of claim 22 wherein said
2 insulative particles provide insulated separation between at least two of said
3 plurality of conductors.

1 30. The semiconductor device of claim 22 further comprising
2 an encapsulation layer encapsulating said plurality of semiconductor
3 elements, said plurality of conductors, and said insulative material.

1 31. The semiconductor device of claim 30 wherein said
2 encapsulation layer includes an overmold encapsulant.

1 32. The semiconductor device of claim 30 wherein said
2 encapsulation layer includes a globtop encapsulant.

1 33. The semiconductor device of claim 30 wherein each of
2 said plurality of conductors have a length at least 250 times greater than a
3 diameter of the respective conductor.

1 34. The semiconductor device of claim 24 wherein a period of
2 time between 2 and 50 seconds is provided for said insulative material to flow
3 prior to curing said insulative material, the period of time being selected
4 based on at least one of a size of said semiconductor device, a temperature
5 of said semiconductor device, a temperature of said insulative material during
6 application to said portion of said plurality of conductors, and a density of said
7 conductors providing interconnection between said elements.

1 35. The semiconductor device of claim 24 wherein a period of
2 time between 7 and 25 seconds is provided for said insulative material to flow
3 prior to curing said insulative material, the period of time being selected
4 based on at least one of a size of said semiconductor device, a temperature
5 of said semiconductor device, a temperature of said insulative material during
6 application to said portion of said plurality of conductors, and a density of said
7 conductors providing interconnection between said elements.

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